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EXAMINER	
CHAMBLISS, ALONZO	
ART UNIT	**PAPER NUMBER**
2827	

DATE MAILED: 11/17/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/985,728	CRANE ET AL.	
	Examiner	Art Unit	
	Alonzo Chambliss	2827	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *28 July 2003*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-61* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-61* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

13)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

a) ☐ The translation of the foreign language provisional application has been received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

1. Amendment A filed on 7/28/03 has been fully considered and made of record in Paper No. 7.

Response to Arguments

2. Applicant's arguments filed 7/28/03 in Paper No. 7 have been fully considered but they are not persuasive.

In regards to the 112 second paragraph rejection based on the phrase " controllably degradable when exposed to appropriate conditions ". The examiner cannot read language from the specification into the claim. The claims have not set forth what the conditions are and what constitutes controllably degradable. Therefore, the 112 2nd paragraph rejection is maintained.

In regards to Gilleo not directed to curable thermosetting underfill compositions. Gill. Gilleo clearly recites that the underfill material is preferably a thermoplastic or a **thermoset having a very low crosslink density** (see col. 4 lines 30-35). Furthermore, just because the focus is on a thermoplastic material does not eliminate the fact that a thermoset can function in the same capacity as the thermoplastic, since the underfill material in the particular embodiment can be either material. Thus, the examiner has reviewed Gilleo as a whole when considering replacing the thermoplastic material with a thermoset having a very low crosslink density. Therefore, Gilleo anticipates the present invention of a thermosetting underfill material.

Applicant alleges that Torres-filho does not disclose, teach or suggest a pre-applied semiconductor circuit chip. Thus, Torres-Filho publication is not properly combinable with the Gilleo reference. This argument is deemed not persuasive because Torres-Filho is not relied upon to show a pre-applied semiconductor circuit chip. Torres-Filho is relied upon to show that a thermosetting underfill composition comprises a curable component made of epoxy resin (i.e. bisphenol-F-type epoxy resin), a curing agent made of amine compounds for promoting cure of the curable component, and optionally, an inorganic filler component made of reinforcing silicas (see page 8 lines 11-20, page 28 lines 1-20, and page 31 lines 4-10). Therefore, one skilled in the art at the time of the invention in light of Gilleo would readily recognize incorporating the thermosetting underfill composition with the device of Gilleo, since the thermosetting underfill composition has greater thermal stability under operating temperatures between a chip and substrate as taught by Torres-Filho.

In regards to Imasu failing in any way to teach or disclose a circuit chip in accordance with the present invention, which involves distinct and separate fluxing agents and thermosetting underfill material disposed on a chip. Imasu is only relied upon to shown that a semiconductor chip is made of silicon (see col. 4 lines 61-63).

Applicant alleges that Wang fails to provide a second thermosetting underfill composition dispensed in a flowable form over the first thermosetting underfill composition. This argument is deemed not persuasive because Wang discloses a second thermosetting underfill composition 310 dispensed in a flowable form over the first thermosetting underfill composition 210 about the electrical contacts 207, 307 and

distinct from the first thermosetting underfill composition 210 and the fluxing agent (see col. 8 lines 10-35, Figs. 6A, 6B, 7A, 7B, 8A, 8B, 9A, and 9B). Clearly, from the lines 10-15, one can see that the encapsulation 210 is applied in liquid form. The second thermosetting underfill composition 310 is rendered non-flowable since both encapsulation 210, 310 are cured at 170 degrees as seen in col. 9 lines 25-54). Therefore, combination of Gilleo, Torres-Filho, and Imasu discloses a chip die having a fluxing agent disposed on electrical contacts on the chip die, and a curable thermosetting underfill composition disposed on the chip die about the electrical contacts and rendered non-flowable, so as to provide an integrated circuit chip assembly for direct attachment to a substrate.

In regards to the PCT application meeting the criteria for novelty and inventive step. As the attorney is well aware of US application having different set rules and guidelines for patentability than PCT application.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claim 18 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

5. In claim 18, the phrase " controllably degradable when exposed to appropriate conditions " is vague and indefinite since it is not clear what the appropriate conditions

are from the claim. Furthermore, it is not clear from the claim what is meant by controllably degradable.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

7. Claims 1, 9-13, 17, 22-24, 49, and 53-56 are rejected under 35 U.S.C. 102(e) as being clearly anticipated by Gilleo (U.S. 6,265,776).

With respect to Claims 1-3, 22-24, 49, 53, and 54, Gilleo teaches a chip die 12 having electrical contacts 14 arranged on a surface thereof for providing electrical interconnection with electronic circuitry on a surface of the carrier substrate, wherein the electrical contacts 14 being flowable upon heating (see col. 3 lines 8-35', Fig. 1). A fluxing agent 16 is disposed on a surface of the electrical contacts 14 at a location capable of providing effective fluxing activity to the electrical contacts 14 of the chip die 12 and the electronic circuitry of the carrier substrate when the chip die is mated with the carrier substrate (see col. 3 lines 23-35;Figs. 3-5). A curable thermosetting underfill composition 18 is dispensed in a flowable form over the chip die 12 about the electrical contacts 14 and treated so as to render the curable thermosetting underfill composition

non-flowable, and curable thermosetting underfill composition being distinct from the fluxing agent 16. The thermosetting underfill composition 18 is substantially free of residue from the fluxing agent 16. The chip die 12 is mated with the carrier substrate to form a mated assembly and upon heating the mated assembly to a temperature sufficient to render the electrical contacts 14 flowable. The electrical contacts 14 flow to provide electrical interconnection between the chip die and the carrier substrate, wherein the thermosetting underfill composition 18 cures, thereby adhering the chip die 12 to the carrier substrate (see col. 3 lines 22-35, col. 4 lines 28-32, col. 7 lines 55-67, col. 8 lines 1-25., and col. 10 lines 27-62, Figs. 3-5). With respect to Claim 2, Gilleo teaches wherein the fluxing agent 16 is disposed over substantially the entire surface of the electrical contacts 14 (see Fig. 5). With respect to Claim 3, Gilleo teaches wherein at least a portion of the electrical contacts 14 is exposed from the thermosetting underfill composition 18 (see Figs. 4 and 5). With respect to Claims 9 and 10, Gilleo teaches wherein the fluxing agent 16 comprises of an organic acid made of Adipic acid (see col. 4 lines 48-67 and col. 8 lines 45-48). With respect to Claims 11 and 12, Gilleo teaches a fluxing agent comprising 5 grams of Adipic Acid (see col. 8 lines 45-50). Therefore, it is inherent that an Adipic acid is a latent organic acid that is a thermally activatable blocked organic acid.

With respect to Claim 13, Gilleo teaches wherein the fluxing agent 16 further comprises an epoxy compound capable of drying to form a film of the fluxing agent 16 on the electrical contacts 14 and capable of reacting with thermosetting underfill

composition 18 upon curing of the thermosetting underfill composition 18 (see col. 8 lines 1-36 and col. 10 lines 27-62).

With respect to Claim 17, Gilleo teaches wherein the electrical contacts 14 comprise solder bumps (see col. 7 lines 12-15).

With respect to Claim 55, Gilleo teaches drying the fluxing agent 16 after the applying step (see col. 7 lines 38-51).

With respect to Claim 56, Gilleo teaches reducing the flowability of the thermosetting underfill composition 18 after the dispensing step (see col. 7 lines 38-55; Figs. 3 and 4).

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to

consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

9. Claims 4-8, 14-16, and 18-21, insofar as definite, are rejected under 35 U.S.C. 103(a) as being unpatentable over Gilleo (U.S. 6,265,776) as applied to claim 1 above, and further in view of Torres-Filho et al. (WO 00/56799) and Imasu et al. (U.S. 6,208,525).

With respect to Claims 4-8, Gilleo fails to disclose a thermosetting underfill composition comprises a curable component made of epoxy resin (i.e. bisphenol-F-type epoxy resin), a curing agent made of amine compounds for promoting cure of the curable component, and optionally, an inorganic filler component made of reinforcing silicas. Torres-Filho discloses wherein a thermosetting underfill composition 3 comprises a curable component made of epoxy resin (i.e. bisphenol-F-type epoxy resin), a curing agent made of amine compounds for promoting cure of the curable component, and optionally, an inorganic filler component made of reinforcing silicas (see page 8 lines 11-20, page 28 lines 1-20, and page 31 lines 4-10). Therefore, it would have been obvious to one skilled in the art at the time of the invention to incorporate the thermosetting underfill composition with the device of Gilleo, since the thermosetting underfill composition has greater thermal stability under operating temperatures between a chip and substrate as taught by Torres-Filho.

With respect to Claim 14, it is well known to have a semiconductor chip made of silicon as evident by Imasu (see col. 4 lines 61-63). With respect to Claims 15 and 16, Torres-Filho discloses wherein a chip die is coated with a polyimide material coated,

wherein the chip die is attached to a carrier substrate made of a glass-reinforced epoxy (see page 19 lines 10-16).

With respect to Claim 18, Torres-Filho discloses wherein reaction products of the thermosetting underfill are cured when exposed to elevated temperatures (see page 5 lines 7-17, page 19 lines 32-39, and page 20 lines 1-38).

With respect to Claim 19, Torres-Filho discloses wherein said thermosetting underfill composition comprises a curable compound (i.e. epoxy resin) having at least one thermally cleavable linkage, a curing agent for promoting cure of the curable compound, and optionally, an inorganic filler component (see page 5 lines 7-17).

With respect to Claim 20, Torres-Filho discloses wherein the compound (i.e. epoxy resin) has at least one thermally cleavable linkage (see page 9-12) is selected from the group consisting of diepoxides including acyclic acetal groups and full and padial episulfide equivalents thereof, diepoxides including secondary carbonyl linkages and full and padial episulfide equivalents thereof, diepoxides including tertiary carb6nyl linkages and full and padial episulfide equivalents thereof, diepoxides including an aromatic moiety within the structure and full and partial episulfide equivalents thereof, and combinations thereof.

With respect to Claim 21, Torres-Filho discloses wherein the thermosetting underfill composition when cured provides a dielectric layer between the chip die and the carrier substrate (see page 20 lines 20-38).

6. Claims 25-48, 50-52, and 57-61, insofar as definite, are rejected under 35 U.S.C. 103(a) as being unpatentable over Gilleo (U.S. 6,265,776), Torres-Filho et al. (WO

00/56799), and Imasu et al. (U.S. 6,208,525) as applied to claims 1 , 49, and 54 above, and further in view of Wang et al. (U.S. 6,168,972).

With respect to Claims 25, 47, 48, 51, and 57, Gilleo, Torres-Filho, and Imasu all fail to disclose a second thermosetting underfill compositions dispensed in a flowable form over the first thermosetting underfill composition about the electrical contacts and treated so as to render the second curable thermosetting underfill composition non-flowable, wherein the second thermosetting underfill composition being distinct from the first thermosetting underfill composition and the fluxing agent. However, Wang discloses disclose a second thermosetting underfill composition 310 dispensed in a flowable form over the first thermosetting underfill composition 210 about the electrical contacts 207, 307 and treated so as to render the second curable thermosetting underfill composition non-flowable, wherein the second thermosetting underfill being distinct from the first thermosetting underfill composition 210 and the fluxing agent (see col. 8 lines 10-35, Figs. 7A, 7B, 8A, 8B, 9A, and 9B). Therefore, it would have been obvious to incorporate a second thermosetting underfill composition with the product of Gilleo, Torres-Filho, and Imasu, since the second underfill composition to facilitate a stronger mechanical rigidity of the mounted assembly and a more uniform distribution of stress across the assemble module as taught by Wang.

With respect to Claim 26, Gilleo discloses wherein the fluxing agent 16 is disposed over substantially the entire surface of the electrical contacts 14 (see Fig. 5).

With respect to Claim 27, Gilleo discloses wherein at least a portion of the electrical contacts 14 is exposed from the thermosetting underfill composition 18 (see Figs. 4 and 5).

With respect to Claims 28-32, Torres-Filho discloses wherein a thermosetting underfill composition 3 comprises a curable component made of epoxy resin (i.e. bisphenol-F-type epoxy resin), a curing agent made of amine compounds for promoting cure of the curable component, and optionally, an inorganic filler component made of reinforcing silicas (see page 8 lines 11-20, page 28 lines 1-20, and page 31 lines 4-10).

With respect to Claims 33 and 34, Gilleo discloses wherein the fluxing agent 16 comprises of an organic acid made of Adipic acid (see col. 4 lines 48-67 and col. 8 lines 45-48).

With respect to Claims 35 and 36, Gilleo discloses a fluxing agent comprising 5 grams of Adipic Acid (see col. 8 lines 45-50). Therefore, it is inherent that an Adipic acid is a latent organic acid, which is a thermally activatable blocked organic acid.

With respect to Claim 37, Gilleo discloses wherein the fluxing agent 16 further comprises an epoxy compound capable of drying to form a film of the fluxing agent 16 on the electrical contacts 14 and capable of reacting with first and second thermosetting underfill compositions 210, 310 upon curing of the first and second thermosetting underfill compositions 210, 310 taught by Wang (see col. 8 lines 1-36 and col. 10 lines 27-62).

With respect to Claim 38, it is well known to have a semiconductor chip made of silicon as evident by Imasu (see col. 4 lines 61-63). Therefore, one skilled in the art at

the time of the invention would readily recognize incorporate a silicon chip with product of Gilleo, Torres-Filho, since the silicon chip provides stable material for allowing the chip to send and receive electrical signals from an external device taught by Imasu.

With respect to Claims 39 and 40, Torres-Filho discloses wherein a chip die is coated with a polyimide material coated, wherein the chip die is attached to a carrier substrate made of a glass-reinforced epoxy (see page 19 lines 10-16).

With respect to Claim 41 , Gilleo discloses wherein the electrical contacts 14 comprise solder bumps (see col. 7 lines 12-15).

With respect to Claims 42, 50, and 52, Torres-Filho discloses wherein reaction products of the thermosetting underfill are cured when exposed to elevated temperatures (see page 5 lines 7-17, page 19 lines 32-39, and page 20 lines 1-38).

With respect to Claim 43, Torres-Filho discloses wherein said thermosetting underfill composition comprises a curable compound (i.e. epoxy resin) having at least one thermally cleavable linkage, a curing agent for promoting cure of the curable compound, and optionally, an inorganic filler component (see page 5 lines 7-17).

With respect to Claim 44, Torres-Filho discloses wherein the compound (i.e. epoxy resin) has at least one thermally cleavable linkage (see page 9-12) is selected from the group consisting of diepoxides including acyclic acetal groups and full and partial episulfide equivalents thereof, diepoxides including secondary carbonyl linkages and full and partial episulfide equivalents thereof-, diepoxides including tediary carb6nyl linkages and full and partial episulfide equivalents thereof, diepoxides including an

aromatic moiety within the structure and full and partial episulfide equivalents thereof, and combinations thereof.

With respect to Claims 45, 60, and 61, Wang discloses wherein the first thermosetting underfill composition 210 when cured provides a first dielectric layer in contact with the chip die 200 (i.e. packaged integrated circuit) and having a coefficient of thermal expansion compatible with the chip die 200. The second thermosetting underfill composition 310 when cured provides a second dielectric layer in contact with the first dielectric layer and the carrier substrate 300 and having a coefficient of thermal expansion compatible with the carrier substrate 300 and the first dielectric layer (see col. 6 lines 13-25, col. 7 lines 18-28, col. 9 lines 19-35).

With respect to Claim 46, Gilleo discloses a chip die 12 having electrical contacts 14 arranged in a certain pattern capable of providing electrical interconnection with electronic circuitry on a surface of the carrier substrate, wherein the electrical contacts 14 being flowable upon heating (see col. 3 lines 8-35; Fig. 1).

With respect to Claim 58, Wang discloses reducing the flowability of the first and second underfill composition 210, 310 after the dispensing step (see col. 9 lines 19-54).

With respect to Claim 59, Gilleo discloses wherein any of the applying and dispensing steps comprise screen printing (see col. 7 lines 34-67).

The prior art made of record and not relied upon is cited primarily to show the product of the instant invention.

Conclusion

10. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning the communication or earlier communications from the examiner should be directed to Alonzo Chambliss whose telephone number is (703) 306-9143. The fax phone number for this Group is (703) 308-7722 or 7724.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-7956

Alonzo Chambliss
Patent Examiner
Art Unit 2827

AC/November 7, 2003